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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

POSTPONEMENT OF THE NEW YORK MEETING

By Dr. F. R. MOULTON
PERMANENT SECRETARY

IN compliance with a direct request of the Office of Defense Transportation, an agency of the Federal Government, the meeting of the American Association for the Advancement of Science and of 44 of its affiliated and associated societies that was scheduled to be held in New York City beginning next December 28 has been postponed, by vote of the Executive Committee. The reason for the request from ODT is the excessive demands on railroads due to the war efforts of the country in general, and to the greatly added burdens due to recent military developments in particular.

Naturally the postponement of a meeting implies that it will be held at a later date. In the present case, however, no definite plans for the future have been made or can be made until the acute transportation problems now existing have been at least partially solved. It is not possible to predict how soon the transportation conditions will improve; as soon as they are improved the ODT will not discourage the holding of scientific meetings.

Instead of drifting, and possibly grumbling, until the future of scientific meetings is clarified, scientists may well consider in all seriousness how their meetings might be improved. Presumably they can be improved in many ways, and if some of the ways of improving them can be discovered during this interval of uncertainty, the disappointments and irritations due to the postponement of the New York meeting will be forgotten.

WARTIME CHEMICALS FROM NATURAL GAS[1]

By Dr. GUSTAV EGLOFF

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FOR many years natural gas has been used mainly for heating and generation of steam and electrical power. In the last few years, however, the tempo of research and development has increased enormously. A much higher field of utilization for natural gas than as fuel is seen in the conversion of the hydrocarbons into superior aviation gasolines, lubricants, synthetic rubber, explosives, acetylene, anesthetics, plant life promoters, plastics, solvents and many other chemical derivatives. A vast supply of these derivatives is available in natural gas produced in this country.

The processes and methods for such conversion in some instances are already in commercial use in the petroleum refining and other industries. Other methods have been worked out in the research laboratories and the processes and yields that can be achieved are known; but it remains necessary for further research to establish the means to reduce costs to the level of commercial practicability. Another wide avenue for future development in the natural gasoline and refining industries is thus foreseen.

Natural gas is consumed at the rate of over 2.6 trillion cubic feet per year. The United States has proven reserves of 85 trillion cubic feet and another 85 trillion as potential reserves. The yearly consumption of natural gas is equivalent in fuel value to 100,000,000 tons of coal or over 500,000,000 barrels of fuel oil.

In the Axis countries, methane gas is a widely used substitute motor fuel. As a matter of fact, there are over 107,000 compressed gas (methane, ethane, propane, butanes) propelled motor vehicles operating in continental Europe, which conserved about 2,300,000 barrels of gasoline for military use. The compressed gas is sold at filling stations in exactly the same way as gasoline in the United States. The gases are compressed under pressures up to 5,000 p.s.i. into steel cylinders attached to the running board of the car or under the floor of trucks and buses. Italy has a number of natural gas wells and is operating many buses and trucks plus a number of locomotives on methane gas. This looks like a desperate measure, since it requires on the average about 135 pounds of steel for each of these high-pressure steel alloy cylinders in order to withstand the high pressures. The products of fermentation of sewage are also used as a source of methane gas in Germany. Methane from coal gas is used for running motor vehicles of one sort or another in many of the European cities. Many coal hydrogenation units produce gasoline in addition to methane, ethane, propane and butanes by the Bergius and Fischer-Tropsch processes. The latter process will be referred to later in more detail because it is a potential source of many products. Buses, trucks, tractors and power shovels, totaling over 25,000 in the United States, use compressed propane and butane. One truck company has liquefied butane functioning in a dual role as a refrigerant for fruits and meats and as motor fuel for the truck after the cooling has taken place.

Hydrocarbons present in natural gas are methane, ethane, propane, butanes, pentanes, hexanes and heptanes, etc. The first four of those are gases, while from pentane on they are liquids useful as gasoline.

The individual hydrocarbons have a variety of uses in a number of industries. Propane has been suggested for use as a fuel for breaking in aviation engines on the "test block" since it has a high octane value and is readily available. Such a procedure would conserve the 100 octane liquid fuels needed for fighter, bombing and cargo airplanes in the war effort. Other uses for propane which have gained wide commercial application are as refrigerants and solvents in the refining of lubricating oils. Paraffin wax, asphaltic substances, naphthenic hydrocarbons and other materials are eliminated from lubricants when propane is used as the solvent. Over 50 per cent. of the world's lubricating oils are improved in quality by the use of propane.

Two hydrocarbons present in natural gas of great utility are isobutane and isopentane. Isobutane is the key hydrocarbon in the production of aviation gasoline by alkylation with olefins. In general, there is not enough isobutane available, hence it has been necessary to isomerize the normal butane present in natural gas to the iso compound. A number of commercial installations are in operation and under construction to isomerize normal butane to isobutane. Normal and iso pentane are also present in natural gas, and it is highly desirable to fractionate out the iso compound due to its 91 octane rating in contrast to the normal, which has an octane number of 64. Isopentane is blended with aviation gasoline in percentages ranging from 10 to 20, depending upon the other components in the final blend.

Olefinic hydrocarbons, not contained in natural gas as such, are important for many reactions not alone

[1] Address before the American Institute of Chemists, Chemists' Club, New York, N. Y., October 23, 1942.

for aviation gasoline but for synthetic rubber and a host of other products. There are several routings to produce olefins from natural gas: one is high temperature, and the other by catalysis. The olefinic hydrocarbons which are now in great demand are ethylene, propylene, butylenes, pentylenes and butadiene. Natural gas, particularly the propane-butane fraction, when subjected to high temperature cracking, produces ethylene, propylene, butylenes and butadiene. Normal butane is readily converted into butadiene in one or two stages by catalytic means at high temperature with yields reported of over 60 per cent.

A branched chain paraffin, isooctane, is of great importance in the aviation fuel program. There are two methods whereby this hydrocarbon is derived—one is by polymerization, in which isobutylene is polymerized to a dimer in the presence of phosphoric acid as a catalyst. Isooctene is the product, and upon the addition of hydrogen, isooctane results. Isooctane has an octane rating of 95–100. Another method of producing aviation gasoline is to polymerize the propylene, butylenes and pentylenes present in cracked gases to a polymer gasoline under selective conditions which upon hydrogenation yields an aviation gasoline blending product of 90 octane rating.

The polymerization process has been largely replaced by the alkylation process in which isobutane is alkylated by butylenes in the presence of sulfuric or hydrofluoric acid catalysts. The resulting alkylate ranges in octane value from 91 to 96. The simplest of the olefins is ethylene, which is used to alkylate isobutane at temperatures in the order of 950° F. and pressures up to 5,000 pounds. This reaction produces neohexane having an octane rating of 94, an important hydrocarbon for aviation gasoline. In addition to alkylating ethylene and butylenes, propylene and pentylenes are also being alkylated with isobutane to form additional quantities of high quality aviation gasoline. It is proposed in some type of operation to utilize the mixtures of propylene, butylenes and pentylenes in the alkylation reaction with isobutane using hydrofluoric acid as alkylating catalyst to produce alkylate of 91 octane rating highly suitable for aviation gasoline blending stock.

An important aviation blending fuel of an entirely different type is cumene, which is produced from the alkylation of propylene and benzene in the presence of solid phosphoric acid. A number of commercial units are now in operation.

Normal hexane and heptane are two hydrocarbons which from a motor fuel standpoint are practically worthless unless their molecular structure is changed. Normal heptane has a zero octane rating and hexane about 25. These straight-chain paraffin hydrocarbons, hexane and heptane, can be changed in configuration and also in their properties to improve their antiknock properties. Hexane and heptane can also be converted into benzene and toluene—two important hydrocarbons for high explosives. Benzene is of vital importance in the production of styrene, which is produced by the alkylation of benzene with ethylene forming ethyl benzene. Dehydrogenation of this compound yields styrene. When styrene (25 per cent.) and butadiene (75 per cent.) are mixed in the presence of a catalyst such as peroxide, polymerization takes place to form the synthetic rubber Buna-S.

The synthetic rubber program in the United States calls for 886,000 tons as planned in September, 1942, distributed as follows:

Types	Tons
Buna-S	705,000
Butyl	132,000
Neoprene	49,000

However, the recommendations of the Baruch Committee called for an increase of 220,000 tons to be apportioned as:

Types	Tons
Buna-S	140,000
Neoprene	20,000
Thiokol	60,000

Out of the total 886,000 tons of synthetic rubber planned for the United States, 705,000 tons of it will come from butadiene and styrene. The normal butane that will be used for butadiene will represent about 80,000 tons a year derived largely from natural gas. One plant has a rated capacity of 66,000 tons and the other 15,000 tons a year.

More than 100,000 barrels a day of normal butane are available from natural gas. If this were used just for butadiene making, it would satisfy the entire butadiene requirements in our present synthetic rubber program. Hence, it can be seen that the natural gas industry has more than enough of the hydrocarbons which can be converted into raw materials to supply the entire synthetic rubber program. Another important source of butadiene is through the dehydrogenation of butylene derived from catalytic cracking. This source will yield at the rate of 283,000 tons annually.

Another type of synthetic rubber is called Thiokol, made by chlorination of ethylene, which is then refluxed with sodium polysulfide. The synthetic rubber program calls for 60,000 tons of Thiokol yearly. Hydrogen sulfide is present in varying percentages in natural gas and is readily converted into flowers of sulfur. This sulfur may react with caustic soda to produce sodium polysulfide. After reacting ethylene with chlorine, the dichlorethane is formed which reacts with the polysulfide yielding Thiokol. The plans call for the use of Thiokol in retreading of tires.

Besides butadiene, styrene and ethylene, a hydrocarbon of great importance is acetylene used in the production of the synthetic rubber, neoprene; it is also the base material for nylon, a replacement product for silk. Calcium carbide is produced from coal and lime in electric furnaces requiring much electrical power. When water is added to this compound, acetylene is formed.

Natural gas or products therefrom under high temperature conditions yield acetylene readily. Two commercial acetylene units are being installed at the present time, one of which will produce at the rate of 75 tons per day or 27,000 tons a year. Other units are also under way. The charging stock may be either propane, butane, natural gasoline or fractions from petroleum. It is believed that acetylene can be produced at a lower cost from processing natural gas than by the electrochemical method of producing calcium carbide. The natural gas industry has enormous volumes of propane and other hydrocarbons available to supply the whole needs of the United Nations for acetylene and its derivatives.

Germany uses acetylene made from calcium carbide, converting it into butadiene by a four-stage chemical process. Neoprene rubber is made from acetylene treated with hydrochloric acid. This type of rubber will be produced at the rate of 49,000 tons a year in the United States.

The Russians start primarily with ethyl alcohol from grain to produce butadiene. Butadiene from ethyl alcohol derived from grain will be one of the sources in the United States synthetic rubber program. The tonnage of butadiene from grain alcohol will be at the rate of 242,000 a year, representing about one third of the Buna-S type production.

There are several other types of rubber which are in commercial production, one of which is the type based on isobutylene from dehydrogenation of isobutane from natural gas or from cracking of oil. Isobutylene is copolymerized with about 2 per cent. of butadiene or isoprene, resulting in a product called Butyl rubber. In the government program this type of rubber will be produced at the rate of 132,000 tons a year. Butyl rubber, as of to-day, is not as good a synthetic rubber for tire use as the Buna-S. Tires made of Butyl rubber have a mileage life of about 12,000 miles with a maximum road speed of thirty-five miles an hour. This will naturally be improved upon.

There is an important use for synthetic rubber which is fabricated so that billions of minute air cells are present; it is used as a liner in gasoline tanks in fighting, bombing and pursuit planes. When a bullet goes through the tank, the rubber causes it to be self-sealing.

Another type of synthetic rubber is the acrylonitrile butadiene which can be produced also from natural gas and is known as Buna-N or Perbunan.

One of the necessary materials in the compounding of either natural or synthetic rubber is carbon black, which is made from natural gas. Carbon black is an important component in tires or other rubber goods whether it is blended with natural or synthetic rubber, as the properties of rubber, particularly from the standpoint of the tensile strength and wearing qualities under service conditions, are greatly improved. During the year 1940 about 369 billion cubic feet of natural gas were converted, largely by the channel process (air oxidation), into carbon black with an average of 1.54 pounds per cubic foot of gas or about 285,000 tons, of which about 85 per cent. was used in tires. Furnace black appears to be superior for use in synthetic rubber.

The world's natural rubber production for 1941 was about 1,675,000 long tons, of which the United States imported over 800,000 long tons. The United Nations have lost over 95 per cent. of the world's natural rubber sources and Russia has lost two of its synthetic rubber plants in the Ukraine.

With the tremendous increased demand for airplanes, tanks, motor trucks, ships, trains, gun mountings, etc., rubber is required in ever-increasing quantities by both the fighting forces and the necessary civilian users for the successful conclusion of World War II. A medium-sized tank requires 500 pounds of rubber, small pontoon bridges, 1,000 pounds; for flying fortresses the gasoline tank alone requires 500 pounds of bullet-sealing rubber, while a large bomber uses 1,250 pounds, gas masks 0.75 pounds, and battleships between 75,000 and 150,000 pounds. Tires for large excavation trucks used by the Army have a diameter of 9.5 feet and weigh over 3,500 pounds. There are many hundred more products requiring rubber that are vital in the war effort, such as blimps, barrage balloons, rubber boats, rafts and life vests and suits for flyers, hospital rubber needs, etc. Millions of soldiers on the fighting fronts require rubber in one form or another.

The synthetic rubber picture in the United States, with its 886,000 tons a year at plant costs of about $800,000,000 is already well under way. The Baruch Committee has recommended that this tonnage be increased to 1,106,000 tons a year. In addition to being the arsenal for many other war products, synthetic rubber will also have to come from the United States to supply our allies' needs. It may well be assumed that even 1,106,000 tons of synthetic rubber will be too low for the United Nations' requirements.

The question arises now: Is the synthetic rubber product equal to the natural? In general, one can say

that synthetic rubber is at least equivalent to the natural; the chemist's goal is not necessarily to synthesize a duplicate of natural rubber, but it is certain that whatever properties rubber has that are needed will not only be duplicated, but radically improved and new ones added. Synthetic rubber is superior to natural rubber in gasoline, oil and chemical resistance. The synthetic product is more stable to light and air, and has greater wearing properties. Some trucks using synthetic rubber tires have gone over 35,000 miles. Sidewall tire strength is greater, meaning greater safety and better road gripability. The latter property has been tested out thoroughly on wet and muddy roads. Tests on hills with different trucks have shown that the synthetic rubber-tired vehicle goes up a hill with very little side-slipping, whereas the tires of natural rubber slipped all over the road. On curves when operating the car at high speeds, the synthetic tire is safer than the natural.

(To be concluded)

INFLUENCE OF THE ENVIRONMENT ON THE EXPRESSION OF HEREDITARY FACTORS IN RELATION TO PLANT BREEDING[1]

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ENVIRONMENTAL influence on the expression of hereditary factors has many aspects. To the geneticist this is the cause of non-hereditary variation. To the experimental taxonomist it helps to explain the status of geographic races. To the breeder it may represent the opportunity to provide adaptability. To the horticulturist interested in cultural problems, differential varietal response to the environment is being increasingly recognized as an important factor in making cultural recommendations. Each aspect has as its fundamental basis the response of the hereditary factors or genes, either singly or more commonly in groups, to the many conditions external to the organism, under which it develops. These outside influences are usually rather complex and difficult to control experimentally. Those most frequently studied are temperature, light intensity and duration, soil and air moisture, wind movement and a variety of nutritional factors.

One of the first careful studies of the effect of the environment on the expression of the gene was made by T. H. Morgan and reported by him in 1915. A strain of Drosophila was found in which the abdomen was defective. This was shown to be sex-linked and to be due to a single mendelian factor. The remarkable thing about it was that only the flies that hatched while the colony was young had the defect, while flies emerging later were normal in every respect. By suitable tests it was shown that flies developing from larvae whose food had been moist had the defective abdomen, while flies whose larval stage was spent on drier food were normal.

[1] Condensed address of the retiring chairman of the Southern Section of the American Society for Horticultural Science, presented at the Memphis meeting on February 5, 1942. Citations to literature have been published with the complete paper in Volume 41, Proceedings, Amer. Soc. Hort. Sci., 1942.

A second component of the environment that has received considerable attention from the geneticists working with fruit-flies is temperature. Zeleny in 1923 showed that an increase of 1° C. during the larval stage decreases the number of facets of bar eye by 10 per cent., of ultra-bar by 8 per cent. and of normal flies by 2.5 per cent. He pointed out that the same effect can be obtained either by increasing the temperature or by adding another bar gene.

Passing on to another insect, the Hymenopterous parasite of the oriental fruit moth (*Trichogramma minutum*) consists of several morphologically similar races that carry different factors for body color which are entirely dependent upon an appropriate temperature for their expression. According to Peterson, when the average daily temperature exceeds 62° F. the females of one race have a distinct lemon-yellow body color, but when the temperature drops below this average these same individuals become a metallic brown. Flanders finds that four races of this parasite can be identified on a basis of color when raised at the same temperature, but when raised at different appropriate temperatures they are indistinguishable. Temperature with this insect not only affects body color but also influences the length of the life cycle, an important character in determining adaptability to climate.

The effect of temperature on the expression of hereditary factors is by no means limited to insects. In Canna, Honing finds that the anthocyanin pigment producing "old purple" is recessive to another factor for yellow. Plants that are homozygous recessive for old purple and heterozygous for yellow (ssWw) are completely yellow during the heat of summer, but later flowers of the same plant developing during cool weather in the fall have a bluish cast. *Primula sinensis* has a form in which the flower is red

at 20° C. but white at 30°. A genetically distinct type has a white flower at both temperatures.

The effect of low temperature on the flowering of biennials depends upon (a) the temperature employed, (b) length of time exposed, (c) stage of development, (d) kind of plant, (e) photoperiod and (f) later growing conditions. All of us are familiar with the necessity of many fruits and ornamentals for cold during the dormant period in order to bloom and fruit normally in the spring. Varieties differ widely in their cold requirements. The use of cold in vernalization treatments to hasten fruiting would seem to be a variation of this same theme. The bearing of these differential responses of plant varieties to heat or to cold on the problems of plant breeding may not be immediately evident to those who handle plants in an environment for which their crops have long been bred or selected. Once these plants are grown outside of their accustomed environment the necessity for hereditary factors that will permit them to grow and produce as an economic crop are soon apparent.

The same may be said of the responses of plants to light. The literature concerning the reactions of plants to photoperiod has become rather extensive. The interest of southern plant breeders in this subject arises from the shortness of the days experienced during both summer and winter compared to the day-length of the normal growing season farther north where many of our commercial varieties were developed.

Often environmental factors other than or in addition to temperature and light make a significant contribution to the appearance or behavior of a plant. Platenius and Knott found that onions on peat are twice as pungent as those grown on sand, and onions on loam are intermediate in this respect. Pungency tends to increase with increased temperature. More sulfur in the soil increases pungency, but more soil moisture decreases it. In spite of these environmental effects, with comparable conditions some varieties are three times as pungent as others.

Available sugars inside the plant are an important factor in the formation of anthocyanin pigmentation. Environmental factors influencing the accumulation of sugars therefore affect plant color. These include soil nutrients, light, temperature, water, available nitrogen and altitude. Owen reports increased mottling of soybean seeds on heavy, rich soil, and sometimes with wider spacing, while increased nitrogen decreased mottling. Ratsek has been able to reduce the intensity of color of red roses to nearly white by defoliation and by pruning away carbohydrate reserves.

Work on the manipulation of a multitude of nutritional factors has now assumed enormous proportions. It is all based on the assumption that the complex of hereditary factors affecting growth and yield are influenced in their expression to a considerable degree by the environment. To return to Drosophila, the vermillion brown stock lacks the amount of eye pigment of normal flies. When the 70-hour larvae are placed on a partial starvation diet the intensity of color is greatly increased. It is estimated that this treatment stimulates the production of the eye color hormone by "not less than a hundredfold" according to Beadle, Tatum and Clancy. In studying a stock of the bent nose Norway rat in which about half of the individuals had this defect when fed a home-made diet, Heston was surprised to get only normal rats when the stock was placed on Purina Fox Chow. It was found that a certain calcium-phosphorus ratio and vitamin D do not allow genes for bent nose in the rat to express themselves.

Work on the effect of nutrients on the fruiting of plants has produced rather striking results. Many fungi are induced to produce sexual spores on artificial media only with great difficulty or not at all. Sax grew field beans with white and with colored seed coats on rich and on poor soil. Factors linked with color gave the higher yield under unfavorable conditions, while factors linked with white seed gave a higher yield under favorable conditions.

A somewhat different type of effect of environment on gene expression is found in its influence on disease resistance. Walker and Smith report a decreased resistance of commercial varieties of cabbage resistant to yellows, with increased soil or air temperature to 28° C. It would seem that both host and pathogen might share in this measurable response in their relationship.

For plant breeders faced with problems of adaptability, as many of us in the South and West are, a good deal of the work in experimental taxonomy has a direct bearing on our problems. It makes no real difference whether the characters that fit a plant for a particular environment are inherited under other conditions or not. Whether the valuable characteristic represents an "environmental variation" from what may be considered the normal type elsewhere, or represents a new genetic combination that can maintain its individuality under other conditions makes a difference only if the climatic conditions the plant breeder faces are so variable that the usefulness of the so-called "environmental variation" is nullified. One of the difficulties in discussions of this kind is the almost universal human error of assuming that the familiar is the only true norm and that all other forms are "off-type." This suggestion obviously has its limitations, as the familiar tends to be the modal type, and environmental variation as observed in the laboratory or under field conditions tends to be continuous. In the widest sense, distinct forms resulting from the

interaction of a genetic complex with contrasting environments do have genetic meaning both for the taxonomist and for the plant breeder.

The problem of adaptation among both wild and cultivated plants is a matter of finding genes whose expression under a particular set of conditions favor growth and maintenance. The essential differences in the two cases lie in the numbers of individuals involved, in the methods of selection and to no small extent in the economic motivation of the breeder. A better understanding of the processes of nature should be of value to the latter.

Vavilov has developed the idea of parallel variation among geographic races and species, calling this the "law of homologous series in variation." He suggests that where plant breeders observe adaptive characteristics in species related to the material they are working with, there might be a reasonable chance of finding or developing the character from their own or the more closely related wild material. The crossing of genetically distinct geographic races may make it possible to transcend the limits of ordinary types.

The work of Massart provides an example of very marked response of a single genotype to different environments. *Polygonum amphibium* may be readily adapted as a land plant, a water plant or a dune type merely by growing divisions of a single individual under these distinct conditions. Each one would be considered a definite geographic race, which is the normal type for each environment.

In discussing the origin of genes responsible for well-adapted climatic races Goldschmidt credits Davenport and Cuenot with the suggestion that genes useful in a new environment arise by mutation and may be carried along by chance until they have an opportunity to express themselves and contribute to the survival of the species under the new conditions. This has been called preadaptation. He even goes so far as to say ". . . we must regard such preadaptational mutations as a prerequisite for the spreading of a species into new areas with different conditions, which would be inaccessible to the original forms. . . ." White discusses the possibility of the existence of genes for cold hardiness among tropical species and those having a southern range. He cites the case of a native Texas pecan that was found to be fully hardy in Canada. Three species of Iris native to Texas proved to be hardy in New York. Occasional mutations for hardiness in tropical plants are likely to be lost if there is no change of climate to give them selective value.

There may be a lesson for the plant breeder in Fisher's theory of the origin of dominance. He supposes that most mutations originally have some effect in the heterozygous condition, *i.e.*, they are partially dominant to their wild-type allel. As this effect is unlikely to be beneficial to the organism, any combination of genetic factors tending to cover up the effect of the new gene will have survival value, and eventually this will become the normal wild type with the new gene fully recessive. Such a complementary effect might be made use of by the plant breeder in outcrosses of valuable but not fully adapted material to secure new genetic combinations that favor the development of the desired characteristic under a particular set of environmental conditions. The value of such a method will depend entirely upon the material available. It should be remembered that the breeding situation among the crop plants is different from that among wild species both in the matter of the effective number of breeding individuals and in the basis of selection. The opportunity for crosses with wild types in many instances permits the incorporation of such recessive genes in the plant breeder's stocks.

Some of the most important characteristics the plant breeder interested in adaptability has to deal with may be classed as physiological. Nilsson-Ehle found that an apparently uniform variety of wheat would become more resistant to cold through the natural elimination of those individuals with genetic factors for tenderness. McKinney and Sando have crossed spring wheat, which requires long warm days, with winter wheat, which first needs cool short days. In order to classify the segregation in the F_2 they found it necessary to grow populations both in the spring and in the fall. Heyne and Laude have tested the resistance of inbred lines of corn to high temperature in the laboratory, securing differential response that checks with field experience. They conclude that "the testing of seedlings for heat resistance can be relied upon with considerable assurance for distinguishing genetic differences in the drought tolerance of larger plants of different strains of maize." Hawthorn has been able to select lines of Bermuda onion less apt to split and double. The point of chief interest to us in connection with this work on wheat, corn and onions is that varieties that are to all appearances entirely uniform, do carry valuable hereditary factors that can express themselves only under suitable environmental conditions.

Before drawing the moral for plant breeders inevitable to such a discussion as this let us review briefly some of the points that have been made: (1) single mendelian factors that have been studied genetically have been found to vary widely in their expression because of differences in environmental conditions; (2) under one set of conditions it may be impossible to distinguish between distinct genetic types while under other conditions they may be quite different in appearance; (3) factors of the environ-

ment that are responsible for these differences include moisture, temperature, light, nutrition and many geographic and cultural conditions that affect these things; (4) there must be appropriate environmental conditions before any gene or combination of genes can have selective value, either natural or in plant breeding, otherwise they may be entirely lost; (5) in tests, suitable conditions may have to be provided artificially; (6) the cumulative effect of modifying factors under a particular set of environmental conditions can be taken advantage of by the plant breeder in improving the adaptability of selections having special market appeal; (7) the value of any heritable character under a particular set of conditions may bear no relation to its development or lack of development under other environmental conditions; (8) work in experimental taxonomy encourages the belief that the adaptability of many crops for southern and western conditions can be materially improved by breeding and selection even though they have been developed primarily for other regions with quite different conditions; (9) improvement might be expected in some cases through intervarietal crosses by accumulating genes from different varieties that may have a favorable effect directly or in combination; and finally (10) in other cases more rapid progress may be expected by outcrossing to wild forms where these are available or by making wide crosses among cultivated forms. Perhaps this summary carries its own moral. As a matter of fact much of the breeding work in the South and Southwest has been and still is in line with these considerations.

This interest in breeding for increased adaptability to southern conditions evident in the past ten years is very encouraging. As the work progresses we may expect an even larger accumulation of hereditary factors favoring quality and production under our conditions. This will make it increasingly easy to synthesize a variety according to certain specifications. There is still a good deal of spade work to be done. This means that we must discover new genes judging their value to us not by their expression under a different environment, but by what they can do under conditions peculiar to our own locality, both as individual hereditary factors and in new combinations. With these it seems reasonable to expect that we can provide the plant material basis for an increasingly prosperous southern horticulture.

SCIENTIFIC EVENTS

RECENT DEATHS

HERMAN STABLER, since 1925 chief of the conservation branch of the U. S. Geological Survey, died on November 24, at the age of sixty-three years.

DR. REUBEN PETERSON, until his retirement in 1931 with the title emeritus for thirty years professor of obstetrics and gynecology at the University of Michigan, died on November 25, at the age of eighty years.

DR. SAMUEL HANFORD MCKEE, ophthalmologist at the Montreal General Hospital, formerly clinical professor of ophthalmology at McGill University, died on November 25. He was sixty-seven years old.

A RECENT message received through the American Red Cross announces the death in Germany on July 5 of Professor Oskar Bolza at the age of eighty-five years. He was a reader in mathematics at the Johns Hopkins University in 1888–89, associate at Clark University, 1889–93, associate professor at the University of Chicago, 1893–94, and professor, 1894 to 1910. For many years past he had been non-resident professor living in Freiburg.

DR. RICHARD B. GOLDSCHMIDT, professor of zoology at the University of California, writes: Mrs. L. Goldschmidt, widow of the crystallographer, Professor Victor Goldschmidt, of Heidelberg, who had been professor there for about forty years and had bequeathed his fine art collection with a large endowment to Heidelberg University, recently committed suicide at the age of eighty-two years, when the Nazis wanted to deport her to a Polish ghetto.

TRANSFER TO THE UNITED STATES OF THE HEADQUARTERS OF THE INTERNATIONAL SOCIETY OF SURGERY

BY a vote of the delegates from all the affiliated societies of the Americas, representing Argentina, Brazil, Canada, Cuba, Ecuador, Guatemala, Mexico, Paraguay, Peru, the United States, Uruguay and Venezuela, the headquarters of the International Society of Surgery has been provisionally transferred from Brussels to the United States.

In explaining the need for the change Dr. Rudolph Matas, of New Orleans, acting secretary and treasurer, said:

> The German occupation of Belgium and the Nazi devastation of the rest of Europe and all the other war-torn nations had virtually restricted the international relations of the society to the Western Hemisphere, where its fellowship is widely spread through its affiliated branches in North, Central and South America.
>
> The Executive Committee of the United States Division, the largest, most active contributor to the transaction, felt it their duty conjointly with their Latin American colleagues to rescue the society from the perils of the Euro-

pean conflagration. The first steps were taken in November, 1941, at Boston, but no final action could be taken to transfer the official sanction in Brussels to America without the concurrence and approval of all the affiliated branches in America.

The act by which the transference of the society was effected was signed either personally or by proxy by the delegates from all the affiliated societies of the Americas.

By action of the Council of Delegates, the official seat of the society will be established in the Inter-American Division of the New York Academy of Medicine, directed by Dr. Mahlon Ashford, where Dr. Enrique J. Cervantes, assistant secretary-treasurer of the executive committee, editor of *America Clinica,* the official organ of the society, and editor and secretary of the Hispanic-American Medical Society, will be able to render service to the fellows of the society and to medical visitors coming from the Latin American countries.

The affairs of the society will be administered by an executive committee composed of Dr. Elliott C. Cutler, Col. M. C., U. S. Army, *chairman in absentia,* Dr. Eugene Pool, Dr. Arthur W. Allen and Dr. Matas.

A meeting held on February 12 was presided over by Dr. Eugene Pool, who serves as acting chairman of the executive committee for the United States, in the absence of Colonel Elliott C. Cutler, now at the front. Dr. José Arce, dean of the University of Buenos Aires, is serving as acting president in the absence of Professor L. Meyer, of Brussels, detained in Belgium by Nazi compulsion.

A revision of the constitution prepared by Dr. Matas was adopted in November and a representative group of fellows from New York and elsewhere signed the act of reorganization, as witnesses of the signing of the act by the delegates of the governing council. These included Dr. Mahlon Ashford, director of the Inter-American Division of the academy, and Dr. Archibald Malloch, librarian of the New York Academy of Medicine; as fellows and guests were Drs. Walter Estell Lee, of Philadelphia; Russell S. Fowler, Ralph Colp, Edwin G. Ramsdell, Frederick W. Bancroft, Howard Lillienthal, Charles Elsberg, Seward Erdman, Carl Eggers, Henry Lyle, and others elsewhere by proxy.

GENETICS IN THE U. S. S. R.

FOLLOWING are the essential parts of a letter written to Dr. M. Demerec, the Carnegie Institution, Cold Spring Harbor, New York, by Dr. S. Gershenson at Ufa, U. S. S. R., on July 6, and received by registered mail on November 20:

My laboratories, both in the Institute of Zoology of the Academy of Sciences of the Ukranian S.S.R. and in the Kiev State University were, like all other scientific institutions, safely evacuated from Kiev. At present the first of them, where I am working, is in Ufa (Ural), the second in Kzyl-Orda (Middle Asia). All our laboratory equipment is with us, but we lost all our Drosophila stocks, among which were some very valuable ones (*e.g.*, a collection of over 100 mutant genes of *D. buscki*, most of which were already mapped, collections of mutant genes from wild populations of *D. funebris*, *D. melanogaster*, etc.), and both our laboratory and private libraries are also lost. This latter loss is especially painful, and I should be greatly obliged to you and to all American geneticists whom I would kindly request you to inform on the subject, for sending of not only the reprints of new works appearing out of press, but also for sending of all old reprints which you can spare. . . .

At present we are actively occupied with selection, breeding and genetics of the oak silk-worm and of cattle. Besides this work on economically important objects, I continue to study the distribution and dynamics of melanism in the hamster—a work that I have been leading during the last three years, and which has already given some interesting results concerning the mechanism of natural selection and the origin of lower taxonomic units. I am also working on some theoretical genetical-evolutionary questions.

Please extend my best regards to my colleagues. Kindly tell them as well as other American geneticists that we are trying here to help all we can in the great fight against fascism and that we unanimously believe in a complete victory over our common foe. We all greatly welcome the recent agreement between U. S. A. and U. S. S. R. and trust that it will lead, among other important results, also to the further development of scientific relations between our countries.

Information received from the Embassy of the U. S. S. R., in reply to inquiries, indicates that books and reprints can be sent by mail in small packages addressed directly to the Academy of Sciences of the Ukranian S. S. R. in Ufa. If, however, the material is very bulky and can only be sent in packing cases, it would be advisable to send it by sea. In that case, the Embassy will be glad to send shipping directions if the weight and dimensions are supplied.

THE ST. LOUIS MEETING OF THE AMERICAN SOCIETY OF AGRONOMY

THE thirty-fifth annual meeting of the American Society of Agronomy was held in the Hotel Statler in St. Louis, Missouri, on November 11, 12 and 13. There were 393 members and guests registered in attendance. The meetings were held jointly with the Soil Science Society of America.

A general meeting was held on the morning of November 12, with President Richard Bradfield presiding. Papers were presented by Dr. O. S. Aamodt and by Dr. Frank W. Parker, of the Bureau of Plant Industry. Following these papers a committee

composed of Dean M. F. Miller of Missouri, Dr. L. F. Graber of Wisconsin, and Dr. R. D. Lewis of Ohio led a round table discussion on "The American Society of Agronomy and the War." The annual dinner was held in the evening, at which time President Richard Bradfield delivered his presidential address. The Crops Section had one general program and eleven subsectional meetings. Thirty-four papers were presented and conferences held on Statistics, Teaching, Alfalfa and Corn Improvement.

The Soil Science Society had one general program and thirteen sectional programs. Eighty-two papers were presented. In addition to formal papers there were discussions of Soil Survey Techniques, Problems of Soil Classification and the Contribution of Soil Survey to the War Effort and Post-war Planning. The annual banquet was held on Wednesday evening, when D. Howard Doane, of the Doane Agricultural Service, St. Louis, gave the address.

A meeting of interest to members of both societies was held on Friday morning. At this session five papers were presented on the general topic of "Cropping Practices in the Great Plains."

Vice-president F. D. Keim, of the Society of Agronomy, announced the names of the fellows elect and presented certificates at the annual dinner. Frank W. Parker was elected vice-president of the society.

THE UPPER PENINSULA MINERAL RESOURCES CONFERENCE

THE Upper Peninsula Mineral Resources Conference was held on November 21 at the Michigan College of Mining and Technology, Houghton, with five federal representatives in attendance. The conference was planned to study exploitation and utilization of the mineral resources of northern Michigan.

The U. S. Geological Survey was represented by Drs. W. S. Burbank, J. J. Runner and C. F. Park, Jr.; the U. S. Bureau of Mines by E. F. Fitzhugh and District Engineer E. P. Barrett; the Michigan Geological Survey by its director, Dr. R. A. Smith; the University of Michigan by Professor K. K. Landes, head of the department of geology; Michigan State College by Professor S. G. Bergquist, head of the department of geology and geography; the University of Minnesota Mines Experiment Station by Director E. W. Davis; the Michigan College of Mining and Technology by a large number of faculty members; and mining companies by their chief geologists, mining engineers and other officials.

The address of welcome was given by President Grover C. Dillman, of the institute. The introductory session was conducted by Dr. Smith. The luncheon address on "Lake Superior Iron Ore and the War Emergency" was delivered by Mr. Davis.

Committees appointed included those on copper ores, iron ores, mineral dressing, non-metallics, geophysical prospecting, federal and state cooperation and planning, and university and college cooperation and specialization.

The chairmen and co-chairmen included Messrs. Burbank, Fitzhugh, Smith, Landes, Bergquist and Dr. T. M. Broderick, chief geologist of the Calumet and Hecla Consolidated Copper Company; E. L. Derby, Jr., chief geologist of the Cleveland Cliffs Iron Company; Stephen Royce, consulting mining geologist representing Pickands Mather and Company; Dean James Fisher, of the Michigan College of Mining and Technology; and Professor N. H. Manderfield, head of the mineral dressing department of the institute.

In charge of all arrangements was Dr. A. K. Snelgrove, formerly of Princeton University and now head of the department of geological engineering at Michigan College.

THE ENGINEERING COLLEGE RESEARCH ASSOCIATION

SEVENTY-THREE engineering colleges from all parts of the country have organized an Engineering College Research Association to cooperate with the war agencies of the Government and with war industry in the prosecution and promotion of research needed for the war effort.

The council of the association, with Dean W. R. Woolrich, of the College of Engineering of the University of Texas, as chairman, held its first meeting in Washington on November 27. The formation of the organization closely follows the establishment by the War Production Board of the Office of Production Research and Development under the direction of Dr. Harvey N. Davis, president of the Stevens Institute of Technology. A close degree of liaison between this office and other governmental and private agencies dealing with wartime research will be maintained by the association in an effort to utilize to the fullest possible degree the vast research facilities of the engineering colleges of the nation.

The association will coordinate the research activities of the engineering college laboratories and personnel for the task of conducting vital studies affecting war materials and production. It will also assist in organizing the research facilities of the engineering colleges in undertaking studies designed to promote post-war reconstruction and economic adjustment through new and improved processes affecting industry, public works, the conservation and development of natural resources, public health and other similar activities. It is further planned that the group will act as a continuing agency for developing and coordinating industrial and scientific research and the furtherance of advanced study in the colleges of

engineering in the United States. It is pointed out that through the cooperation of such a large number of leading engineering schools expensive and wasteful duplication of effort will be avoided, and that a maximum utilization of facilities and personnel and a high degree of coordination will result.

In addition to Dean Woolrich other officers of the association are: Dean Earle B. Norris, Virginia Polytechnic Institute, *First Vice-president;* President C. C. Williams, Lehigh University, *Second Vice-president;* Dean R. L. Spencer, University of Delaware, *Treasurer.* Council members of the group are Dean Ivan C. Crawford, University of Michigan; Dean Thorndike Saville, New York University; Dean Samuel B. Morris, Stanford University; Dean F. M. Dawson, the State University of Iowa; Dean N. A. Christensen, Colorado State College, and Dean G. M. Butler, University of Arizona.

This is the first time that the research departments, institutes and experimental stations of technological institutions have been brought together in an organization of this kind. While most of the members are already associated in other professional and educational groups, they have never joined hands for the express intention of coordinating and stimulating engineering research. It brings together in one group institutions with research facilities valued at many million dollars.

SCIENTIFIC NOTES AND NEWS

ORVILLE WRIGHT has been elected an honorary member of the British Institution of Mechanical Engineers in recognition of "his distinguished contributions to mechanical science." It is said in the citation that "his early pioneer research and eminent scientific attainments have richly endowed the annals of science."

THE twenty-seventh annual dinner of the Institute of Medicine of Chicago was held at the Palmer House on December 2. The dinner was in honor of Dr. Ludvig Hektoen and Dr. James B. Herrick, who have been active members of the Board of Governors since the founding of the institute in 1915. Dr. James P. Simonds spoke on "Ludvig Hektoen: A Study in Changing Scientific Interests," and Dr. J. Christian Bay on "James B. Herrick: Youth in Man Makes History."

DR. BERNARD SACHS, neurologist and founder of the neurological division of Mount Sinai Hospital, past-president of the New York Academy of Medicine, who will be eighty-five years old on January 2, was presented at a special ceremony on November 24 with a volume of 700 pages containing eighty-three original papers on the progress of neurology, compiled in honor of his sixty years of medical practice and research. Dr. Foster Kennedy, chief of the Neurological Service at Bellevue Hospital, presided.

DR. F. W. HODGE was elected president of the Western Museums Conference at the recent Los Angeles meeting.

AT the second annual meeting of the Montana Academy of Sciences, held on October 30 and 31 at Helena, the following were elected to office for the coming year: Rev. B. J. Topel, Carroll College, *President;* Dr. Harold Chatland, Montana State University, *First Vice-president and Editor;* Dr. D. Q. Posin, Montana State School of Mines, *Second Vice-president;* Dr. R. W. Hiatt, Montana State College, *Third Vice-president,* and Professor Melvin S. Morris, Montana State University, *Secretary-Treasurer.* The academy, in the organization of which Dr. Gordon B. Castle, of Montana State University, and Dr. Harlow B. Mills, of Montana State College, took a leading part, was planned in 1940 at a general meeting held in Great Falls.

DR. EDWIN F. GILDEA, associate professor of psychiatry at the School of Medicine of Yale University, has become professor of psychiatry and administrative head of the department of neuropsychiatry at the School of Medicine of Washington University, St. Louis.

DR. HAROLD PHILLIPS HILL, clinical professor of medicine at the School of Medicine of Stanford University, San Francisco, has been made professor emeritus. Dr. Victor E. Hall and Dr. John Field, II, in physiology, and Dr. Charles E. Smith in public health and preventive medicine have been promoted to full professorships.

THE enlargement of a program of research into the causes of cancer has been made possible at the University of Minnesota by a gift of $5,500 a year for five years from the Citizens Aid Society of Minneapolis to support what will be known as the George Chase Christian professorship in cancer research. Dr. John J. Bittner, now associate director and vice-president of the board of directors of the Roscoe B. Jackson Memorial Laboratory at Bar Harbor, Maine, has been appointed the first incumbent of the chair. Associated with Dr. Bittner, who will study the cancer problem as a geneticist, will be Dr. Maurice B. Visscher in physiology and Dr. Robert G. Green in bacteriology.

F. W. PARKER, of E. I. du Pont de Nemours and Company, Inc., has for the duration of the war become chief of the Division of Fertilizer Research of the Bureau of Plant Industry. He succeeds R. M. Salter, who has been made chief of the bureau.

DR. D. P. MORGAN, chemical consultant for Scudder, Stevens and Clark of New York, has been appointed director of the chemicals division of the War Production Board.

DR. WALLACE H. WULFECK, formerly associate director of marketing research at the Psychological Corporation of New York, has been appointed director of research for the Federal Advertising Agency of New York.

DR. WILLIAM T. ANDERSON, JR., for nearly twenty years director of the radiation research laboratory of the Hanovia Chemical and Manufacturing Company, has been granted leave of absence to enable him to accept a commission as a lieutenant in the Naval Reserves.

DR. S. A. SALETORE has been appointed director of the Laxmi Narayan Institute of Technology at Nagpur, India. Dr. A. Nagaraja Rao, of the Imperial Institute of Sugar Technology, Cawnpore, has been appointed professor of applied physical chemistry in the same institute.

LIEUTENANT COLONEL G. R. ENSMINGER, of the Safety and Security Branch of the U. S. War Department, has been appointed a member of the Sectional Committee of the American Standards Association on Allowable Concentrations of Toxic Dusts and Gases. The committee will determine and promulgate the allowable concentration limits of harmful gases, vapors, fumes, dusts and mists in the atmosphere of working places, from the viewpoint of the prevention of occupational disease.

HENRY ROY DEAN, F.R.S., professor of pathology at the University of Cambridge, has been elected representative of the university on the General Medical Council for the next five years.

THE first annual Robert J. Terry Lecture was delivered before the St. Louis Medical Society on December 1 by Dr. Stuart Mudd, Philadelphia. He spoke on the "Morphology of Pathogenic Bacteria and Viruses as shown by the Electron Microscope, with Some Practical Implications." The lecture was established through a bequest of $5,000 in the will of Dr. William T. Coughlin, who died in May, 1940.

DR. IRVINE MCQUARRIE, professor of pediatrics at the Medical School of the University of Minnesota, delivered on November 3 and 4 addresses of the Porter Lectureship in Medicine of the School of Medicine of the University of Kansas. His subjects were "Experiments of Nature and the Advancement of Medical Knowledge," "Medical Experiences in Besieged China" and "Diseases of Adrenal Glands in Children."

DR. A. F. BLAKESLEE, formerly director of the Department of Genetics, Carnegie Institution of Washington at Cold Spring Harbor, now William Allan Neilson professor at Smith College, gave two lectures at Toronto on November 21, one in the series of Saturday evening public lectures of the Royal Canadian Institute on "Controlled Development of Plants" and the other to members and friends of the Botanical Club of the University of Toronto on "Segmental Interchange in the Evolution of Chromosomes."

DR. A. J. CARLSON, of the University of Chicago, spoke before the Syracuse Chapter of Sigma Xi on December 2. His address was entitled "Some Unknowns in the Physiological Pathology of Aging."

DR. ALEXANDER SILVERMAN, head of the department of chemistry of the University of Pittsburgh, will make an address at the Franklin Institute on December 16. He will speak on "Glass and the War."

DR. E. D. MERRILL, administrator of botanical collections at Harvard University and director of the Arnold Arboretum, delivered from November 12 to 18 a series of lectures at Cornell University on the origin of cultivated plants, under the auspices of the Joseph H. Schiff Foundation. In connection with the three lectures in this series he also conducted a seminar on problems of botanical bibliography and one on the botanical work of C. S. Rafinesque.

DR. COLIN M. MACLEOD, of New York University, and Dr. Alphonse R. Dochez, of Columbia University, will participate on the evening of December 7 in a discussion on "The Atypical ('Virus') Pneumonias" at the College of Physicians and Surgeons, New York. This is the second program arranged by the New York Bacteriologists' War Research Projects Group to review bacteriological problems of importance for the war in order to formulate research projects to be undertaken by members of the group.

WORKERS with the electron supermicroscope held a symposium in Chicago on November 27 under the leadership of Professor G. L. Clark, of the University of Illinois. The symposium was planned as part of the National Chemical Exposition. In addition to representatives of the laboratories already having electron microscopes, many government and industrial laboratories sent representatives. The symposium was the first opportunity that workers in this

field have had to exchange ideas and information about techniques and problems. It may lead to a permanent organization. Among the subjects discussed were problems of operation, of mounting specimens, enlarging electron micrographs, interpreting the micrographs and of using the electron microscope for electron diffraction and in the examination of bacteria, cells, rubber, synthetic rubber, cellulose, colloids, powders, clays, ores, smokes, oils, etc. The latest types of electron microscopes were exhibited. Dr. V. K. Zworykin, associate director of RCA Research Laboratories, gave a lecture on the relation of the electron microscope to chemical research.

THE Committee on Meteorological Education of the American Meteorological Society, Professor A. F. Spilhaus, chairman, recently organized a panel of readers from members of the society who are willing to review manuscripts of meteorological books for publishers who may wish to use this service of the society. The panel consists of a number of professional meteorologists, each an expert in one or more phases of the field. Publishers wishing to avail themselves of the services of the panel are asked to address inquiries to the chairman of the Committee on Meteorological Education, stating the type of manuscript to be reviewed. The committee will suggest the individual or individuals on the panel who would be best suited to make the review. In Canada this procedure will be cleared through Dr. Andrew Thomson, the Canadian member of the committee.

THE new plant for the manufacture of electronic tubes of the National Union Radio Corporation at Lansdale, Pa., was formally opened recently with ceremonies in which Army and Navy officers participated. The National Union Company was welcomed to Lansdale by Floyd B. Kulp, president of the borough council, and S. W. Muldowny responded for the company. The plant, representing the most advanced design and construction, is 40,000 square feet in area. Included in it are offices, laboratories and complete manufacturing facilities. All activities are carried out on a single level.

As of November 28, 397 staff members of the University of Illinois had entered the military and navy armed services, while 31 others had been granted leaves for the war service other than in the armed forces. These include members of the university at Urbana and of the Colleges of Medicine, Dentistry and Pharmacy at Chicago.

AT the request of the National Research Council, Washington, D. C., the department of botany of Field Museum, Chicago, is preparing manuals of plants of the tropics which are likely to be of special interest or concern to soldiers, sailors and marines at posts in Latin America. The manuals describe and figure plants which are poisonous or otherwise noxious, as well as those which are valuable as sources of food for enlarging the diet or as emergency rations. The manual on the plants of the Guianas and Brazil, of which a section on poisonous plants has already been printed, is being prepared by Dr. B. E. Dahlgren, chief curator of the department. The manual of plants of Central America is in the hands of Paul C. Standley, curator of the herbarium.

THE Yale chapter of the Society of the Sigma Xi has announced the election of 95 new members and associates who come from 20 states and Argentina and Canada. Of those chosen, 12 are faculty members and research fellows, 44 are graduate students, and 39 are undergraduates. Six undergraduates in Yale College, the School of Engineering and the Sheffield Scientific School received the extraordinary honor of election in their junior year.

DISCUSSION

THE OLD STARFISH-CLAM QUESTION

THE question as to how a starfish can open a clam so as to insert the starfish's stomach between the valves and thus digest the clam has been discussed for generations.

Any one who has tried to pry open the valves of a clam or oyster will feel sure that no starfish could force the valves apart by any sudden pull. During some recent experiments the writer tested the force necessary to open average-sized oysters and little-neck clams (*Venus*) by inserting a steel hook in a notch ground in each valve and then pulling with a large spring scale. One oyster, after having been subjected to a pull of 1,500 grams for 40 hours required 22 pounds pull with the scale before the adductor muscle was torn apart. Another oyster under similar conditions required a pull of 30 pounds. Several clams subjected to a pull of from 23 to 26 pounds were still intact when the shells broke. It would seem, therefore, that instead of being able to resist a sudden pull of 4,000 grams, as has been stated, these bivalves may withstand a pull of from 10,000 to 14,000 grams, or more. It is to be noted, also, that the hooks used in the above experiments were attached to the middle of the margin of the shells, where the greatest leverage was exerted, while only a relatively small number of

tubefeet could find attachment along this ventral margin, and many attached near the hinge would have practically no leverage.

Many of the text-books of zoology discuss this subject and several of them quote from Shipley and MacBride, as in the following, from Newman's "Outlines of General Zoology," 1936: "'It was long a puzzle how the starfish succeeded in forcing its victim to relax its muscles and allow its valves to open. It was supposed that the stomach secreted a paralyzing poison, but it has been conclusively known that this is not the case, but that the starfish drags the valves of its victim apart by main force, often actually breaking the adductor muscles. The pull exercised by the suckers is not nearly strong enough to open the valves at once, but the starfish has staying power and eventually the muscle is slowly forced open.' The secret of the unusual endurance of the starfish is that its tubefeet work in relays, some resting while others work." It will be noted that Newman ascribes the supposed great endurance of the starfish to the working in relays of the tubefeet.

In Bigelow's "Applied Biology," 1911, is given another theory which seems very reasonable. He says: "A starfish fastens its suckers on an oyster, and then the stomach covers the edge of the oyster's shell with the result that the currents of water are stopped and the animal within the shell is killed by suffocation. The shell then gaps open, the starfish's stomach pours in its secretion, the tissues of the oyster are dissolved (digested) while in its own shell, . . ."

How completely the stomach of the starfish covers the edges of the bivalve shells the writer has never noticed; but it seems likely that, at least in the case of those having well-developed siphons, it would only be necessary to cover the region where the siphons are located.

In the fifth edition (1942) of his "College Zoology" Hegner is non-committal, saying simply: "Starfish are often destructive in oyster beds since they succeed in pulling open the shells and devouring large numbers of these bivalves."

In a personal letter Thurlow C. Nelson, an oyster specialist, says: "I have always been most skeptical of the current idea that a starfish opens an oyster by main force." He says, "What I said was that a starfish can not exhaust an oyster owing to the fact that the muscle when closed automatically locks." He refers to the discussion of this locking mechanism in Bayliss's "Principles of General Physiology."

Some three dozen clams (*Venus*) and oysters were tested, by the writer, to get some idea as to their endurance. The bivalves were bought at stores in Morgantown and had all doubtless been out of the sea for considerable but varying lengths of time. The artificial sea water, mostly simply 3.5 per cent. NaCl, was usually at the laboratory temperature from 20° to 27° C. It is likely that under these rather unfavorable conditions the endurance of the molluscs was somewhat reduced. A small notch was ground, on a carborundum wheel, in the ventral edges of the valves, just large enough to insert two small steel hooks. One hook was fixed, the other was attached to a cord that ran over a pulley and had an easily changeable weight attached. The animal was suspended, ventral side up, in the salt water. The extreme ventral edges of the valves were just above the surface of the water. As the valves were forced open the gape was measured, at intervals, in millimeters. There was not much variation in the sizes of the specimens used. A considerable variation was noted in the endurance of both oysters and clams, possibly due to the differences in their individual vitality, just as some will live out of water much longer than others. For example, one clam, whose valves did not seem tightly closed, was opened and its muscles torn apart in 45 minutes by a pull of 3,700 grams; while another clam endured the same traction for 48 hours without the muscles tearing, though the valves gaped 26 mm.

Various weights from 900 to 4,000 grams were used. One oyster with a pull of 1,500 grams, which is more than the estimated strength of the starfish (however, this strength may have been estimated) at the end of 5 days had a gape of only 12 mm, wide enough, perhaps, for the insertion of a starfish stomach. Another oyster, under 1,500 grams traction, had a gape of 11 mm and required a pull, with the spring scale, of 22 pounds (more than 10,000 grams) before it could be torn apart, at the end of 48 hours. One clam, under a traction of 1,500 grams, remained tightly closed for about 45 hours, and at the end of 5 days had a gape of only ½ mm; at the end of 8 days the gape was 7 mm (rather narrow for insertion of a stomach); on the ninth day the muscles were torn apart.

In some cases the valves opened for a millimeter or two within a few minutes, but when the valves were tapped with a pencil they snapped together instantly. In general this more-or-less sudden closure of the valves when tapped occurred even after several hours or even days.

This fairly early opening to a very slight degree might lend support to the theory that the starfish secretes over its victim a paralyzing fluid, since the fluid could pass through a narrow opening that would be quite impassable for the stomach of the starfish. Of course the starfish may have unbelievable endurance, especially if it can rest its tubefeet by using them in alternate groups, as suggested above by Newman.

It would be interesting to test the strength and endurance of perfectly fresh specimens under normal, sea conditions.

A. M. REESE

WEST VIRGINIA UNIVERSITY

THE FIRST FREE-LIVING FRESHWATER JELLYFISH FROM SOUTH AMERICA

THIS past March, Mr. German Frick, an engineer residing in Santiago, Chile, was much surprised to see jellyfish moving about in a small body of fresh water in Tranque Marga-Marga, near Quilpué (Province of Valparaíso), 40 kilometers from the sea. Seeking more information about them, he took several of them to the senior author who, in turn, appreciating the uniqueness of the discovery, forwarded the specimens to the U. S. National Museum, along with a very realistic, original sketch of the animals.

A comparison with preserved material in Washington readily permits the identification of both sketch and specimens with the well-known widely distributed *Craspedacusta sowerbii* (Lankester). This species has heretofore been reported from Europe (Austria, Czecho-Slovakia, England, France, Germany, Holland, Poland and Russia), Asia (China and Japan), the Hawaiian Islands, twenty of the United States of North America, Panama (in the Canal Zone near Barro Colorado Island) and from an aquarium only at Porto Alegre, Brazil.[1] The present record, however, is the first for the free-living freshwater medusae in South America.

The medusae varied from 5 to 10 mm in diameter. They were much disintegrated after their long voyage to North America. There were at least five series (sizes) of tentacles, and probably seven in the largest specimen; the smallest specimen had only four series.

CARLOS E. PORTER

SANTIAGO, CHILE

WALDO L. SCHMITT

WASHINGTON, D. C.

DEFORMATION OF ROCK STRATA BY EXPLOSIONS

A RECENT note by Boon and Albritton[1] mentions the Sierra Madera Dome of western Texas as an example of a structure which might possibly have been formed by explosion from a meteoric impact.

It happens that in the course of a routine gravity survey in Pecos County, Texas, stations were made on and around Sierra Madera. The results of this work have been indicated in another connection in a paper by Hammer.[2] The gravity work indicates a positive gravity anomaly with a relief of about 3.5 mg.[3] Presumably if the geologic structure were caused by a meteoric impact, the only explanation for the positive gravity anomaly would be excess mass brought in by the meteor. The form and width of the gravity anomaly can be accounted for by a concentrated (*i.e.*, spherical) mass with its center at a depth of the order of 8500′ and with a total excess mass of the order of 4×10^{15} grams. If it were assumed that this were a sphere of meteoric iron, the required diameter would be about 3000′. The gravity anomaly is quite well centered over the topographic feature and therefore the excess mass must be substantially vertically below the surface geologic feature.

The depth and mass required to explain the gravity anomaly both seem much too large to be associated with a meteorite. Therefore, the geophysical contribution makes it seem much more probable that this feature is caused by igneous intrusion or some other more ordinary geologic processes rather than being the result of a meteoric explosion.

L. L. NETTLETON

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SEGREGATION OF TYPE SPECIMENS

THE result of inquiries made by a committee of the Systematic Section of the Botanical Society of America and the American Society of Plant Taxonomists shows that of about 76 North American herbaria known to contain type specimens, 23 keep their types segregated from the main collections. In 8 of these, including the U. S. National Herbarium, Gray Herbarium, New York Botanical Garden, Philadelphia Academy, Rocky Mountain Herbarium and the herbaria of the Universities of Pennsylvania, North Carolina and Arizona, the segregation is in progress, but not complete. The Los Angeles Museum has its types stored in a vault in the interior of the country for the duration of the war. The U. S. National Herbarium is preparing to move its type collection to a safer location during the war, but this has not yet been accomplished. The New York Botanical Garden is in the midst of the process of segregation, and as the types are removed from the main collection, they are being sent to an institution in a safer locality.

About 20 of the collections containing types are housed in buildings which are not fireproof. This includes such important herbaria as the U. S. National Herbarium, the Bailey Hortorium and the Arthur Herbarium of rust fungi at Purdue.

What the above means is that in at least 20 American herbaria types are exposed to the risk of fire,

[1] Rudolf Gliesch, *Egatea*, 15: 145–148, figs. 1–11. Porto Alegre, Rio Grande do Sul, 1930. Gives notes on occurrence of both polyps and medusae in an aquarium at Porto Alegre; *Microhydra* is synonymous with *Craspedacusta*.

[1] J. D. Boon and C. C. Albritton, Jr., SCIENCE, n.s., 96: 2496, 402, October 30, 1942.

[2] Sigmund Hammer, "Terrain Corrections for Gravimeter Stations," *Geophysics*, 4: 3, 187, July, 1939.

[3] 1 mg. = 1 milligal = .001 cm/sec.^{2}

and in at least 53 they are handled every time the covers of the species they represent are taken out, even for routine determination, filing, etc. Over a period of years this handling inevitably results in breakage.

Considering that types are irreplaceable and that they are one of the basic assets of the science of botany, the complacency of American botanists is indeed remarkable. That many European scientific institutions have been severely damaged by bombs is an indisputable fact. Yet apparently only three institutions in the United States are taking steps during the war to get their types out of bombing range. This is almost beyond belief, considering the magnitude of steps taken in other aspects of civilian defense throughout the nation.

F. R. FOSBERG

FALLS CHURCH, VA.

QUOTATIONS

THE PITTSBURGH MEETING OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE[1]

TO THE MEMBERS OF THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE:

WHEN the American Association for the Advancement of Science and all similar societies planned their winter meetings, the present situation could not have been foreseen. We had not even entered the war, and did not dream of a congestion of transportation such as now exists. When the present situation had developed, it was (in the opinion of a majority of the committee having power) too late to postpone our meeting.

Transportation is now so greatly overtaxed that necessaries of life can barely be carried; the railways should be spared every extra burden. Great simultaneous pilgrimages on important trunk lines are especially to be avoided, since they demand extra trains, needing extra locomotives and coal, and causing much confusion. Therefore, in my opinion it behooves every patriotic and unselfish member to consider very seriously whether he can really serve his country by attending the meeting, or whether he can not better serve in this fateful time by staying at home, especially during a period of highly congested travel, when many of our soldiers may wish to take leave of their families before departing for the front. I believe that only those persons bringing really important contributions to the problems of the war should attend such meetings now. All others, in my opinion, should conserve their money for Liberty bonds and for those in distress, and should save their strength for action in this time of extraordinary crisis. For these reasons, with great regret, I have decided not to attend the meeting at Pittsburgh.

So far as I have been able to ascertain, all the responsible authorities at Washington concerned with transportation agree with me as to the importance of avoiding unnecessary journeys in such a crisis.

The very great usefulness of the American Association for the Advancement of Science is not dependent upon the unbroken continuity of its social meetings.

Science is incalculably important, indeed indispensable, in this world-wide cataclysm. The excellent work of the association in the past is now bearing fruit; but this moment demands action rather than general discussion. We must devote all our energies to winning the war. Let us all make every endeavor to apply our knowledge and strength in our country's noble cause.

THEODORE W. RICHARDS,
President of the Association

CAMBRIDGE, MASS.,
DECEMBER 15, 1917.

SCIENTIFIC BOOKS

CHEMISTRY

The Chemistry of Organic Medicinal Products. By GLENN L. JENKINS and WALTER H. HARTUNG. xii + 457 pp. Planographed by John S. Swift Co., Inc., St. Louis. 1941. $6\frac{1}{2} \times 9\frac{1}{2}$ in. $3.00. Bound in stiff paper.

THIS book, by the dean of the Purdue University School of Pharmacy and the professor of pharmaceutical chemistry of the School of Pharmacy of the University of Maryland, has been written primarily as a text-book for those advanced students in pharmacy who have had the requisite training in chemistry, particularly organic chemistry, but should prove useful also to the organic chemist interested in this field and to the medical practitioner who wishes to know something more about the chemistry of the drugs he is prescribing.

The classification of the subject-matter is strictly chemical, although not following entirely the customary division into the major groups of I. Acyclic (or Aliphatic), II. Isocyclic, and III. Heterocyclic.

[1] SCIENCE, December 28, 1917, p. 638.

Acyclic and isocyclic compounds are discussed together in chapters whose headings are determined by the particular functional groups present. Thus, the chapter entitled "Hydroxyl Derivatives of Hydrocarbons" deals with Alcohols, Polyhydroxy Alcohols, Unsaturated Alcohols, Cyclic Alcohols, Sterols, Aromatic Alcohols, Phenols and Halogenated Hydroxyl Compounds, in that order. After considering the acyclic and isocyclic compounds in such chapters, there follow two on Heterocyclic Compounds and a final one on Stereoisomerism. Before proceeding to a consideration of the separate chapters, a bibliography of standard reference works likely to be helpful to the reader, and occupying five pages, is inserted; in addition to which numerous references are given throughout the text.

Although, as already noted, the classification varies somewhat from the conventional, the volume constitutes an abbreviated text-book of organic chemistry, in which the usual sections on isomerism, nomenclature, preparation, physical and chemical properties, are supplemented by paragraphs or sections on physiological activity and, where justified, on the apparent connection between such activity and chemical structure. Pharmacological and therapeutic information is presented concisely without attempting to record details more appropriate for treatises in these special fields. Uses and modes of administration are also recorded, as well as the accepted trade names for the more important drugs.

The ancient materia medica, consisting largely or wholly of natural products of complex and variable composition, are rapidly being displaced by the products of the organic chemists' laboratory, and ere long most of them will be as extinct as the dodo, giving place to such triumphs of the laboratory as arsphenamine, the hormones, vitamins and the sulfanilamides. The book is profusely illustrated with structural formulas, tables, charts and diagrams, and is provided with an excellent index. A laboratory manual to accompany the text has been prepared by Drs. Hartung, Summerford and Dunker.

Chemistry of Insecticides and Fungicides. By DONALD E. H. FREAR. viii + 300 pp. 6¼ × 9¼ in. New York: D. Van Nostrand Company, Inc. April, 1942. $4.00.

IN these days of global warfare, when every one is praying for an early cessation of the conflict, we can not overlook the fact that we are engaged also in another kind of struggle, in which our enemies are not fellow humans but other living organisms, and that this war has been going on since the dawn of man's history and will probably continue until its close. Little is to be feared from the larger animals, for they all recognize man as their master and their fate as in his hands; but it is in the smaller animals and the lower forms of life that man finds his deadliest and most implacable enemies. These attack him either directly, by causing various diseases, or indirectly by destroying his means of subsistence. One of the important hostile armies in the latter category is that of the plant pests, and the present book discusses the chemistry of those compounds which have been found useful as insecticides or fungicides, in order that the campaign against these enemies may be conducted more intelligently and more successfully.

The text is based upon a graduate lecture course organized and given by the author at the Pennsylvania State College, and each chapter concludes with an excellent bibliography.

After the Introduction, the separate chapters are grouped under five general headings as follows: *Part I. Stomach Poisons or Protective Insecticides.* Arsenicals, Lead Arsenate, Fluorine Compounds and Miscellaneous Stomach Poisons; *Part II. Contact Poisons or Eradicant Insecticides.* Nicotine and Pyrethrum, Rotenone and Miscellaneous Contact Poisons, Sulfur and Inorganic Sulfur Compounds, Oils and Fumigants; *Part III. Fungicides.* Copper Compounds, Mercury Compounds and Miscellaneous Fungicides. *Part IV. Spray Supplements and Residue Removal.* Wetting, Spreading and Emulsifying Agents, and Spray Residue Removal; *Part V. Analytical Methods.* Macro Methods and Micro Methods.

As can be seen from these titles, the book should be useful to inorganic, organic and bio-chemists, as well as to plant pathologists and economic entomologists, and it is cordially commended to them. Paper, type, presswork and binding are admirable; the proofreading has been done carefully; and some interesting illustrations of natural products are included.

MARSTON TAYLOR BOGERT
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A FRESHMAN TEXT IN MATHEMATICS

Basic College Mathematics, A General Introduction. By CARL WALLACE MUNSHOWER and JAMES FLETCHER WARDWELL. xiii + 612 pp. New York: Henry Holt and Company. 1942.

THIS text is designed to cover in one year essential selected topics in algebra, trigonometry, analytic geometry and calculus, so as to provide a profitable terminal survey for students taking but one college course in mathematics, and also an introduction for those who prepare for further mathematical work. The subject-matter organization is intended to furnish a psychologically acceptable unified course with the rate concept introduced in the first chapter. So much material has been provided in these twenty-one

chapters that many teachers might desire to omit some entire chapters. The planning of these separate chapters is expected to afford wide freedom of choice for such omission, or for rearrangement, without interfering with the student's progress. The chief claim to novelty lies in the wide variety of fields from which verbal problems have been gleaned. The text has been prepared with somewhat more than average care, although the reviewer notes several definitions and formal explanations which seem not above criticism. Answers are provided for odd-numbered problems. Approximately the last hundred pages are devoted to numerical tables, reference formulas and (somewhat incomplete) index.

ALBERT A. BENNETT

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SPECIAL ARTICLES

AN INFECTIOUS AGENT FROM CASES OF ATYPICAL PNEUMONIA APPARENTLY TRANSMISSIBLE TO COTTON RATS[1]

RECENTLY a primary atypical pneumonia of unknown etiology has been a rather common disease.[2] Observations made in this laboratory since March, 1941, suggest that in some cases of this disease an infectious agent is transmissible to cotton rats (*Sigmodon hispidus*) and produces pulmonary consolidation after the first intranasal inoculation of sputum or lung under ether anesthesia. Both the eastern cotton rat (subspecies *hispidus*) and the western cotton rat (subspecies *eremicus*) are susceptible.

The results with material from a total of 78 cases of atypical pneumonia are summarized in Table 1.

TABLE 1

RESULTS OF INOCULATING COTTON RATS WITH SPUTUM OR LUNG TISSUE FROM CASES OF ATYPICAL PNEUMONIA

	Days after onset	Number of specimens causing lung lesions	Number of specimens causing no lung lesions
Sputum	5 or less	8	11
Sputum	6 to 9	4	15
Sputum	10 or more	1	19
Sputum	unknown	2	9
Lung	.....	2	7
Total		17	61

Similar material gave negative results in mice, ferrets, hamsters and other animals. Sputums taken early in the disease often produced lung lesions rather consistently when several cotton rats were inoculated with the same specimen. Fully grown or old animals were more susceptible than those 3 to 7 weeks of age. Of the total of 131 cotton rats receiving material from cases of atypical pneumonia 35 developed lung lesions. Thirty-four control cotton rats inoculated intranasally with throat washings from cases of influenza or with heated sputum, horse serum broth or other materials did not develop significant lung lesions. All animals were sacrificed 7 days after inoculation. Only one out of more than 50 cotton rats used in experiments not connected with atypical pneumonia has shown lung lesions at autopsy.

By serial intranasal passage of lung suspensions from animals which had lesions on the first passage, strains of an infectious agent from 6 cases of atypical pneumonia were adapted to cotton rats. In 2 cases this adaptation was repeated, starting from the original sputum, but using cotton rats of a different subspecies. After 4 to 6 passages the adapted strains produced gross evidence of lung involvement in over 90 per cent. of the animals inoculated, but seldom caused death. With sputum from 11 cases lung lesions were produced on first inoculation, but no adaptation by serial passage was obtained. When the lungs of normal cotton rats or of animals which developed no lesions after inoculation of sputum were passed serially, the results were uniformly negative.

The lung lesions were patchy red-gray with maximum intensity at 6 to 8 days. Microscopic examination of sections of lungs showed an infiltration of the septa with polymorphonuclear leucocytes and mononuclear cells and hyperplasia of the alveolar epithelium. No inclusion bodies, elementary bodies, rickettsiae or visible microorganisms were seen in sections or in impression smears stained by the methods of Gram, Giemsa or Macchiavello. Cultures on blood agar and horse serum broth were negative. In 2 out of 6 filtration experiments using Berkefeld N candles passage of the agent was demonstrated.

Strains which had been adapted to cotton rats produced lung lesions after intranasal inoculation of Syrian hamsters (*Cricetus auratus*), but caused no detectable disease in mice, rabbits or guinea pigs. Animals which had recovered (in about 14 days) from intranasal inoculation of the pneumonia agent were solidly immune to reinoculation by the same route. Infected cotton rat lung produced neither illness nor

[1] The studies and observations on which this paper is based were conducted with the support and under the auspices of the International Health Division of The Rockefeller Foundation in cooperation with the California State Department of Public Health. Most of the material for laboratory studies was obtained through the courtesy of physicians at the Medical Center and the Cowell Memorial Hospital of the University of California.

[2] For literature review and references see J. H. Dingle and M. Finland, *New England Journal of Medicine*, 227: 378, 1942.

immunity when inoculated intracerebrally or intraperitoneally into cotton rats.

Neutralization tests with serum-virus mixtures incubated for 1 hour at 37° C. and then kept in the icebox overnight were performed by inoculating cotton rats and hamsters intranasally. Sera from hyperimmunized cotton rats, hamsters and rabbits gave definite neutralization of the agent. Partial or irregular neutralization was observed with sera of human beings convalescent from atypical pneumonia, with sera of cotton rats inoculated once only or of guinea pigs inoculated repeatedly with cotton-rat adapted strains, and with sera from rabbits immunized with human lung infectious for cotton rats.

By cross-inoculation and neutralization tests antigenic relationships between 6 established strains were demonstrated. Cotton rats immunized by two successive intranasal inoculations with adapted strains were solidly immune to reinoculation with a specimen of infectious human lung which produced marked lesions in the controls. Cotton rats immunized with human material were partially resistant when tested with adapted strains.

During the course of serial passages from cotton rats which developed lung lesions on the first inoculation, two strains not antigenically related to those just described were obtained. These two "aberrant" strains may have been carried by the cotton rats and had apparently replaced the agent present in the first passages.

The appearance of non-bacterial lung lesions in cotton rats after inoculation of material from cases of atypical pneumonia suggests that a virus-like agent was transmitted and established by serial passage. The strains adapted to cotton rats were related to the agent in human material by cross-immunity tests. This agent, which is presumably a filterable virus, differs from the psittacosis-like virus previously described[3] and also from other known viruses which can infect cotton rats by the intranasal route. At present the evidence for the causal relation of this agent to the most common form of atypical pneumonia must be considered incomplete because of irregularities in the neutralization tests, particularly those with human serum. Further investigations on the influence of the amount of the infecting dose on the neutralization test are in progress.

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[3] M. D. Eaton, M. D. Beck and H. E. Pearson, *Jour. Exp. Med.*, 73: 641, 1941.

DESTRUCTION OF HYPERTENSIN AND PEPSITENSIN BY AN AMINOPEPTIDASE OBTAINED FROM YEAST

THE vasoconstrictor properties of hypertensin (angiotonin) and pepsitensin—a substance formed by the digestion of proteins with pepsin—can be entirely destroyed by an aminopeptidase (a.p.) enzyme obtained from yeast and purified by the Johnson method.[1]

These two hypertensive substances incubated with that enzyme at 38° and neutral pH. lose their vasoconstrictor properties in a few minutes.

Approximately 0.01 cc of the final purified solution obtained from 2 kg of compressed yeast destroys them after 5- to 10-minutes incubation (2 or 3 units of hypertensin or pepsitensin). The degree of destruction of these two products under the influence of the enzyme was controlled by the method previously described, using the Loewen Trendelenburg test and the arterial pressure of the cat.[2]

The mixture of hypertensin or pepsitensin with the enzyme was injected after different periods of incubation and the vasoconstrictor or pressor effects obtained were compared with those produced by an equal dose of substrate and the enzyme mixed immediately before injecting. Sometimes as a means of controlling the results, a mixture of enzyme was used, incubated for the same length of time, and previously inactivated by boiling with the vasoconstrictor substance (Fig. 1).

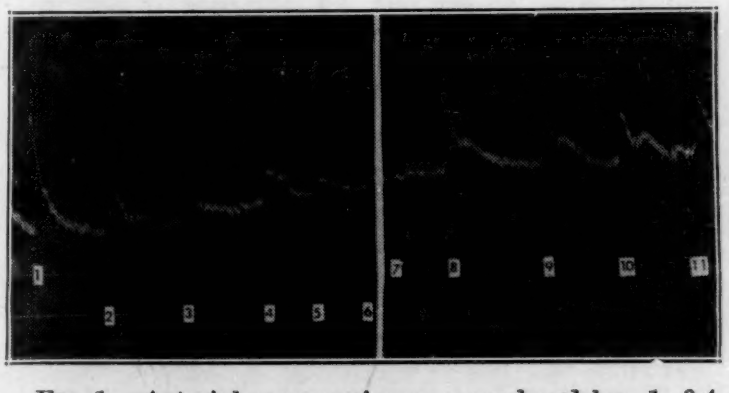

FIG. 1. Arterial pressure increase produced by: 1: 0.4 cc hypertensin; 2,3,4,5,6: 0.5 cc hypertensin incubated 5′ with 0.0025, 0.005, 0.01, 0.02 and 0.03 cc of a.p. 676 F respectively 7: 0.5 cc water with 0.03 cc a.p. 672 F 8,9,10,11: 0.5 hypertensin.

Titration of polypeptid nitrogen during incubation showed a progressive and considerable diminution. A similar result was obtained when renal hypertensinase acted upon hypertensin or pepsitensin.

The hydrolytic activity of yeast enzyme on synthetic substances allows one to classify this enzyme as a.p.[3] Hypertensinase extracts of pig kidneys, purified by

[1] M. J. Johnson, *Jour. Biol. Chem*, 127: 575, 1941.
[2] H. Croxatto and R. Croxatto, SCIENCE, 42: 101, 1942.
[3] J. S. Fruton, G. W. Irving, Jr. and M. Bergmann, *Jour. Biol. Chem.*, 141: 763, 1941.

acetone precipitation, and yeast enzymes hydrolyze l-leucylglycine. Hypertensinase and a.p. differ in their action on dl-methyl leucyldiglycine in that the former hydrolyze this polypeptide, while a.p. has no action. This effect may be due to the co-existence of other enzymes contained in the kidney extract, among others renin, which could not be completely separated (Table 1)[4].

TABLE 1

HYDROLYTIC ACTION OF a.p. OF YEAST AND OF HYPERTENSINASE ON SYNTHETIC SUBSTRATES

Enzyme	Undiluted enzyme cc	Time of incubation minutes	Hydrolysis, per cent. dl leucyl-glycine	Hydrolysis, per cent. dl M leucyl-diglycine
a.p. of yeast				
656 I	0.3	30	100	0
619 I	0.1	30	100	0
672 E	0.01	30	100	0
672 F	0.01	30	100	0
672 F	0.002	30	67	0
672 F	0.001	30	33	0
Hypertensinase				
655 II	0.1	180	100	33
655 II	0.1	30	100	18
655 I	0.1	30	100	38
655 I*	0.01	30	30	16
655 II	0.01	30	90	41
655 II	0.01	30	90	=
655 II†	0.01	30	0	=
655 II	0.03	30	100	31
655 II	0.02	30	=	=
655 II	0.02	30	=	=
655 II	0.10	30	=	=
655 II	0.03	30	=	=

* 655 I is a less concentrated product than 655 II.
† The enzyme was previously boiled. 100 per cent. means the total hydrolysis of a peptidic bond. 619 I contains more than 1,000 U. per gr of N. 655 II contains 425 U. per gr of N. 672 F contains 3,000 U. per gr of N. (Johnson) (1). a.p. hydrolyzes 100 per cent. leucyldiglycine. Chloracetyl-tyrosine and carbobenzoxyglycyl-l-sarcosine are not hydrolyzed by 655 II.

Moreover the a.p. acts like hypertensinase extracts, whether aerobically or anaerobically; it does not destroy tyramine and its effects on adrenalin are slight or nil.

The destruction of hypertensin and pepsitensin by a.p. establishes a similarity between both vasoconstrictor substrates which is added to those already described.[5] Their polypeptid nature is confirmed and the supposition that these vasoconstrictor substances possess a free NH_2 radical is strengthened. Hypertensinase activity of renal extracts may also be attributed to the existence of a.p. enzyme contained in kidney tissue.

The fact that renin acts as a hydrolytic enzyme of proteinase character (like pepsin)[6] places the cathepsins in a very important position in the problem of experimental hypertension.

[4] Our sincerest thanks to Dr. M. J. Johnson and Dr. M. Bergmann for their kindness in offering the polypeptides used in this paper.

[5] H. Croxatto and R. Croxatto, *Soc. Argent. Biol.*, 17: 439, 1941.

[6] R. Croxatto, H. Croxatto and J. Sorolla, *Rev. de Med. y Aliment. Chile*, 5: 135, 1942.

Conclusions: An a.p. enzyme separated from yeast inactivates both hypertensin and pepsitensin by a process of hydrolytic destruction. Purified hypertensinase containing renal extracts show a.p. activity.

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THE OCCURRENCE OF INTRAVASCULAR AGGLUTINATIONS IN AVIAN MALARIA[1]

INTRAVASCULAR agglutinations or clumps have been described by Knisely and co-workers as occurring in experimental monkey malaria and in various clinical conditions in man. The development of the Knisely quartz rod micro-illuminator has for the first time made possible an adequate study of histophysiology and histopathology of the circulation.

Using a quartz rod micro-illuminator the pathological changes of the circulation were studied in canaries infected with *Plasmodium cathemerium.*[2] The circulation was studied in eight infected and two normal canaries by placing the tip of the rod beneath the dorsal surface of the wing web. The canary was held in place with a specially designed holder which allowed exposure of a wing web ventral side up. A drop of mineral oil placed on the epithelium of the web facilitated visualization of the circulation at 96 × magnification.

All experimentally infected birds developed extensive infestations with parasite counts up to 67 per cent. and all but one died. As the parasite count began to rise progressive pathological changes were noted in the peripheral circulatory tree.

The initial changes were characterized by a loss of "streamlining" of flow, a slowing of the flow rates as indicated by a change in the contour of the parabolic fronts and transient stickings of white blood cells to the endothelial lining of the veinules. These changes were soon followed by evidences of early tissue damage such as plasma leaking with a spreading and rounding of fat cells due to an increase in interstitial fluid. The white cells became plastered to the endothelium in ever-increasing numbers and stuck with increasing cohesiveness as the infection progressed.

These initial changes, together with an increasing

[1] This is a preliminary report of observations in avian malaria supported by the Tennessee Valley Authority malarial research program at the University of Tennessee School of Medicine. The author wishes to acknowledge the courteous suggestions and counsel extended to him by Dr. Melvin H. Knisely, of the Department of Anatomy, University of Chicago.

[2] The canaries were given a standardized infection through the courtesy of Dr. Redginald Hewitt, malariologist for the Tennessee Valley Authority.

parasitization, soon led to the development of more profound intravascular pathology, namely, the formation of sticky masses or clumps of red cells. These clumps or agglutinations were seen first only in the venous stream, were small (three to four red cells) and possessed but little intrinsic cohesiveness. As these clumps flowed into larger veins the shearing forces to which they were exposed broke them up. During the early stages of clump formation transient thromboses occurred and the flow rate was markedly retarded to sluggish in many areas.

In the subsequent 24 to 48 hours the usual picture was that of progressive intravascular clumping with the formation of larger agglutinated masses, more permanent thromboses and increasing tissue damage. The clumps or agglutinations now could withstand intravascular stresses as they circulate throughout the organism, appearing occasionally in arterioles. Streamlining was completely disrupted even in the large veins draining the area under observation. The viscosity of the plasma increased. This was demonstrated by the appearance of resistance met by a free red cell as it turned over in its path down stream and entered successively larger currents. These intravascular changes together with the intermingling of broken red cell clumps, free red and white cells and a rare white cell clump reminded one investigator of "sludge." This term vividly pictures the very marked intravascular pathology little evidence of which would be found with routine autopsy methods.

The circulatory damage resulting from these intravascular pathological changes together with the increasing parasitization precipitated a stage of generalized clumping which represented a status of irreversible pathology progressive to eventual circulatory failure. The clumps or agglutinated red cell masses, which were initially formed by parasitized red cells only and later by both infected and normal red cells, were less fragile than previously and showed marked intrinsic cohesiveness. The clumps stuck to one another and would, therefore, stick to the phagocytes of spleen, liver and bone marrow. However, their great size presented a mechanical difficulty that the phagocytes could not overcome (this fact has been demonstrated by M. H. Knisely in unpublished data). White blood cells stuck to the endothelium in layers, plasma leaking and skimming were marked, the paste-like blood flowed very sluggishly and thromboses became numerous. There was a further increase in the viscosity of the plasma subsequent to the marked plasma leaking. These circulatory changes were regularly followed by the death of the bird within a few hours.

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SCIENTIFIC APPARATUS AND LABORATORY METHODS

THE PREPARATION OF A SUCRASE-FREE TAKA-MALTASE

TAKA-DIASTASE is, as is known, a mixture of different enzymes including maltose and sucrose-splitting factors.

Leibowitz[1] advanced the theory of a specific gluco-maltase in taka-diastase distinct from taka-sucrase.[2] This view was opposed by Weidenhagen,[3] who postulated the existence of only one maltase identical with gluco-sucrase. Leibowitz and Hestrin[4,2] found a way to differentiate between the two disaccharide-hydrolyzing capacities of the taka-diastase owing to the greater thermostability and acid stability of the maltose-splitting factor.

The present paper describes a simple method for preparing maltase free from sucrase from the commercial taka-diastase (Parke, Davis and Company). The lability of taka-sucrase to reducing agents $N_2S_2O_4$, reported in a previous communication,[5] is exploited for this purpose.

2 gr of the commercial sample of taka-diastase were dissolved in 15 ml distilled water in a Cellophane bag and the solution under toluene dialyzed at room temperature for one day against running tap water and one day against distilled water, which was changed several times, until the solution is free of reducing substances.

The dialyzed solution (about 30 ml) was filtered into a glass-stoppered flask and mixed with 0.3 gr of sodium hydrosulfite. After 24 hours at room temperature, the $Na_2S_2O_4$ is removed by dialyzing the solution in a Cellophane bag for one day against running tap water and one day against distilled water, which is changed several times.

The dialyzed solution, showing only maltase activity, was highly diluted. To concentrate, dialysis against a 45 per cent. dextrine solution according to the method of Guy E. Youngburg[6] was attempted, but this method proved generally impracticable because of the reducing substances diffused in the concentrated solution from the dextrine. We succeeded

[1] J. Leibowitz, *Zs. physiol. chem.*, 149: 184, 1925; J. Leibowitz and P. Mechlinsky, *ibid.*, 154: 64, 1926.
[2] Cf. Sh. Hestrin, *Enzymologia*, 6: 193, 1940.
[3] R. Weidenhagen, *Ergeb. Enzymforsch.*, 1: 169, 1932; *Zs. physiol. chem.*, 216: 255, 1933.
[4] J. Leibowitz and Sh. Hestrin, *Nature*, 141: 552, 1938; 143: 339, 1939.
[5] J. Feigenbaum, *Biochem. Jour.* (1942) in press.
[6] Guy E. Youngburg, SCIENCE, 94: 498, 1941.

in finding a simple method of concentration, using 96 per cent. ethyl alcohol as the dialyzing liquid or "outside solution."

According to this method, 40 ml of the taka-diastase solution free from $Na_2S_2O_4$ is concentrated by dialyzing through a Cellophane bag for about six hours against 96 per cent. alcohol as "outside solution," the alcohol being changed two or three times.

During the concentration, part of the enzyme was precipitated and deposited on the Cellophane. After concentration the small residual solution (about 3 to 5 ml) was precipitated by the same volume of absolute alcohol, centrifugated and, together with the Cellophane bag (containing very active substance) dried in the desiccator over H_2SO_4. The yield was about 50 mg, *i.e.*, 2.5 per cent. of the original substance.

Using the same method, we concentrated solutions of the commercial taka-diastase without any treatment by reductants (which required only half the time of the concentration of the taka treated by $Na_2S_2O_4$). The yield was about 3 per cent. of the commercial product. Owing to the small quantity of the taka-diastase it sometimes happened that all the substance was precipitated and deposited on the Cellophane. In this case, the substance after drying was either carefully separated from the Cellophane, or pieces of the Cellophane containing the enzyme were placed in water and filtered off after the substance had dissolved. The substance precipitated on the Cellophane was even more active than the substance precipitated from the concentrated solution by absolute alcohol.

The dried product was tested for activity on maltose and sucrose. It was found that the product retained the full maltose activity splitting power of the original preparation but was practically inactive on sucrose.

This confirms the theory that taka-maltase and taka-sucrase are two distinct enzymes.

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A PLATINUM SCOOP FOR TRANSFERRING STERILE POWDERS

THE transfer of small quantities of sterile powder or chemicals to another container or a medium usually is accomplished with a loop or with a pipette having a wide bore. By such a procedure some powder usually is spilled or scattered on the table, which is obviously undesirable. To overcome this inconvenience, the writer has devised a platinum scoop (shovel) which will accomplish conveniently the transfer of powder from a container or test-tube to another container or a culture medium.

The scoop is made by folding a piece of platinum sheet into a U-shaped shovel which is attached with a platinum wire, a copper wire or lead glass to an inoculating needle holder. Fig. 1 illustrates three sizes: (a) $24 \times 5 \times 2$ mm; (b) $25 \times 5 \times 3$ mm; (c) $20 \times 10 \times 3$ mm. Scoop (a) will hold about 0.17 grams of starch powder; (b), 0.23 grams; and (c), 0.45 grams.

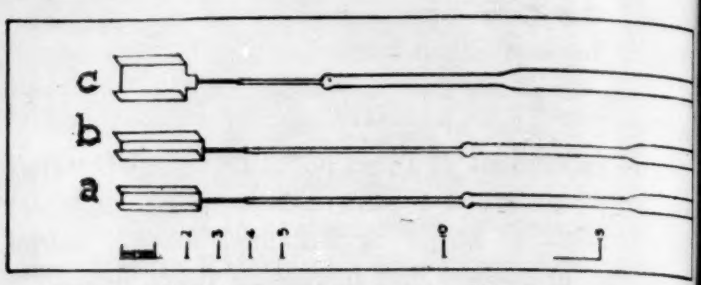

FIG. 1. Platinum scoops (a) $24 \times 5 \times 2$ mm; (b) $25 \times 5 \times 3$ mm; (c) $20 \times 10 \times 3$ mm.

This scoop has been successfully used by the writer in adding sterile rice starch and starch and charcoal to various media for culturing *Endamoeba histolytica* and *Trichomonas vaginalis*. These scoops can be used also in analytic chemical weighings, and have several advantages over glass or metal spatulas.

This simple apparatus has the advantages of being readily sterilized by flame and requiring only a few seconds for cooling. Because of this, the transfer of sterile powder and chemicals is conveniently and neatly accomplished for a large number of culture tubes or containers in a short period of time.

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